REMARKS

In the Office Action, Claims 1-3, 6 and 7 stand rejected under 35 U.S.C. §102(e). Claims 8, 11-13, and 15-18 stand rejected under 35 U.S.C. §103(a). For the reasons set forth below the Applicants respectfully traverse each of these rejections. The Commissioner is authorized to charge deposit account 02-1818 for any fees which are due and owing.

In the Office Action, Claims 1-3, 6 and 7 stand rejected under 35 U.S.C. §102(e) as anticipated by U.S. Patent Application Publication Number 2002/0040805 (hereinafter 'Swager').

Claim 1 of the application recites a functional molecular element composed of a molecule with a permittivity anisotropy and/or dipole moment, a metal ion, and a conjugated molecule. The two molecules form a complex with the metal ion. The conductivity of the conjugated molecule is then changed when the action of an electric field induces a change in the orientation of the molecule with the permittivity anisotropy.

Swager fails to anticipate the claimed invention at least for two reasons. First, Swager *does not teach or suggest* altering the conductivity of a nanoscopic pathway by the action of an electric field. Swager describes a nanoscopic pathway into which are integrated nanoscopic switches. See, e.g. [0009] The nanoscopic switch is a chemical or biological species capable of altering the conductivity of the nanoscopic pathway [0059] either through a redox active process [0060], mediation of charge via a chemical reaction [0061], or by change of conformation due to an organic group in the switch that changes conformation upon charge transfer [0063]. Note that all three of these processes require some sort of oxidation or electron charge transfer to occur at the switch in order to effect a change in the activity of the nanoscopic pathway.

The charge transfer process is different from the action of an electric field, as the Applicants argued in the previous Response to Office Action, and Swager fails to teach this claim limitation. In Response to Arguments in Item 22, page 9 of the Final Office Action, the Examiner asserts that "the action of an electric field" in claim 1 is the same as charge transfer because charge transfer occurs by action of an electric field at the molecular scale.

Applicants respectfully disagree. First, it's unclear what authority the Examiner is using to suggest that charge transfer on a molecular scale and an electric field are the same. Second, the nature of the terms and their common usage by one of ordinary skill in the art indicates the

opposite conclusion. Charge transfer requires a charge, e.g. a positive or negative ionization, to transfer from one molecule or atomic center to another. That charge transfer can occur by electrochemical processes, or by a favorable pairing of redox elements, e.g. M_1 and M_2 undergoing an oxidation-reduction coupling to form M_1^+ and M_2^-. See [0059]-[0062] and [0074] in Swager. Third, note that charge transfer, as used by the Examiner in the rejection of claim 12 (see Item 14, page 5), is described as a primary input/output means for the conjugated molecule. See [0052]. Therefore, it's counterintuitive to assert that the charge transfer can serve as the basis for both the conductivity in the conjugated molecule and the means for acting on a molecule that would disrupt the very conductivity that the charge transfer serves to produce.

In comparison, the action of the electric field on the molecule with a permittivity anisotropy and/or dipole moment is different. Specifically, molecules which have a permittivity anisotropy and/or dipole moment will align themselves in the presence of an electric field. That alignment does not occur due to an oxidation or reduction or chemical modification of the molecule, but only due to the molecule's efforts to align an axis direction, *e.g.* the major axis direction for a positive permittivity anisotropy, with the orientation of the electric field. See page 17 of the specification. As further illustrated therein, this shift in alignment effects a conformational change on the complex with the conjugated molecule, metal ion and molecule with permittivity anisotropy and/or dipole moment *in the absence of ionization*, and thereby can create a change in the conductivity of the conjugated molecule.

Swager also fails to anticipate the claimed invention because it does not teach that the conjugated molecule, the molecule with permittivity anisotropy and/or dipole moment and the metal ion form a complex. The Examiner has pointed to places within Swager where each of these concepts occur, but the reference does not teach a complex containing all three. While Swager does teach a metal ion as part of the switch and the metal ion as part of the nanoscopic pathway (particularly as exemplified by the rotaxane complexes,) the reference to paragraph [0066] suggests that the Examiner considers the double-stranded polymer attached by an intermediary species which could be a metal ion as anticipating the claims. However, this structure fails to anticipate the claimed invention. In paragraph [0066], Swager teaches two <u>polymers</u> – the nanoscopic pathway polymer 24 and the dielectric polymer 26 – that can be attached by attachment 25 which could be a metal ion. The nanoscopic pathway polymer and

metal attachment arguably may be similar to a conjugated molecule and a metal ion complex, but the molecule with a permittivity anisotropy and/or dipole moment is not the same as the dielectric polymer of paragraph [0066]. The only arguable support for the dielectric being a molecule with a permittivity anisotropy and/or dipole moment occurs in [0073]. However, that paragraph gives a laundry list of dielectrics, *none of which are polymers*. Among the list are ceramics, silicates, water, organic solvent, a gas (preferably inert gas such as helium, neon or argon), a liquid crystal phase such as sodium dodecylsulfate or pentyl substituted cyanobiphenyl. Instead, Swager defines and describes dielectric polymers in later paragraphs [0080]-[0089], particularly [0087] listing the dielectric blocks in a block copolymer which are polyolefins, polyesters, polyamides, etc. These dielectric polymers are distinctly different from molecules with a permittivity anisotropy and/or dipole moment. Furthermore, Swager clearly differentiates the broad category of dielectric from the narrower sub-category of dielectric polymer. See claims 18, 19 and 20. Dielectric polymers as in [0066] are a subset of the dielectric, and liquid crystal molecules are a very small subset of the dielectric, but the two subsets are not the same and do not overlap. See specifically claim 18, as well as claims 19-24.

Because Swager does not contain an electric field acting on the complex, and because Swager fails to provide the complex of a metal ion, a conducting molecule, and a molecule with a permittivity anisotropy and/or dipole moment, Swager fails to anticipate the claimed invention, and thus the rejection should be withdrawn for at least these reasons.

Claim 8 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Swager. The Examiner asserts that while Swager does not expressly disclose silver, it does disclose that the metal ion can be a transition metal in claim 16, and therefore it would have been obvious to choose silver as the transition metal because silver is a well-known transition metal.

Applicants respectfully disagree with this interpretation. Claim 16 in Swager depends from claim 15, wherein the metal is part of the *nanoscopic pathway*, e.g. the conjugated molecule of the instant application. In this regard, claims 15 and 16 in Swager cover only a metal ion in the nanoscopic pathway, and do not cover the metal ion that is in a complex with the conjugated molecule and the molecule with a permittivity anisotropy. Therefore, the obviousness rejection fails and should be withdrawn for at least this reason and further in view of the differences between Swager and the claimed invention as discussed above.

Claims 11-13 and 16-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Swager in view of U.S. Patent No. 5,608,556 (hereinafter 'Koma'). Base independent claim 11 describes a functional molecular device comprising a molecule with a permittivity anisotropy and/or dipole moment, a metal ion, a conjugated molecule, with the two molecules forming a complex with the metal ion, an electric field applying means that applies an electric field to the molecule with permittivity anisotropy, and an input/output means for the conjugated molecule, wherein a conductive path is formed by the conjugated molecule and conductivity is controlled by changing the electric field.

The Examiner asserts that Swager discloses all the elements except for 1) an electric field applying means that applies an electric field and 2) that conductivity of the conductive path is controlled by changing the electric field that acts upon the molecule with permittivity anisotropy. Item 13 on page 4 of the Final Office Action. Koma teaches a liquid crystal display with provides a wide viewing angle and high display quality. Col. 1 ln. 9-12. As part of the LCD technology, voltage applied to an electric field causes the liquid crystal layer 41 to change its orientation state. No description of the liquid crystal layer or of a conductive path is given. Thus the Examiner seems to be relying on Koma only for the electric field to control the liquid crystal orientation.

Koma fails to cure the defects in Swager for failing to disclose a conjugated molecule and a molecule with a permittivity anisotropy and/or dipole moment in a complex with a metal ion as previously discussed. Koma does contain an electric field applying means that applies an electric field, but neither Koma nor Swager describe controlling the conductivity of the conductive path by changing an electric field. Furthermore no motivation to combine the two references is present and the combination still fails to teach the claimed invention as described.

As discussed above, Swager teaches that a nanoscopic pathway can be insulated with a dielectric, and that dielectric can be a liquid crystal compound. Assuming that combination between Swager and Koma was proper, the combination leads to a dielectric liquid crystal layer, a nanoscopic pathway and an electric field. This combination is not the claimed invention; in fact this combination is described in comparative example 1 on page 36, where the field effect molecular device in the absence of a silver ion shows *no change in conductivity* due to the

application of the electric field. Therefore, the combination of Koma and Swager should not be considered to cover the claimed invention.

Furthermore, there is no motivation to combine the two references. The Examiner asserts that "they are from the same field of endeavor, devices using liquid crystal molecules. It would have been obvious … to add the electric field applying means that applies the electric field to the molecule with permittivity anisotropy and/or dipole moment of Koma to the device of Swagger. The motivation…would have been to control the orientation of molecules." Item 13 on page 4 of Final Office Action. This field of endeavor argument is improper because it goes against the very terms that each reference asserts. The field of endeavor in Swager relates to articles, devices, compositions and methods involving conduction pathways of nanoscopic thickness, including sensors for a variety of analytes. [0002] In comparison, the field of endeavor in Koma is a liquid crystal display (LCD), particularly a LCD that provides a wide viewing angle and high display quality. Col. 1, ln. 9-12.

Furthermore, the Examiner asserts that "it is reasonable to presume that one of ordinary skill in the art of liquid crystals would be aware of both references and cognizant of the reasons of combining them." It's not clear what the reasons for combining them are, other than that they both mention liquid crystal. In effect, this argument would be that any common technological material, e.g. liquid crystals, plastics, aromatic rings, organic solvents, etc., would allow the combination of any references using those common technological materials. That argument is overly broad. Furthermore, the cognition the Examiner alleges is present here exists only because the Examiner is relying on Applicants' specification to combine the two references. In the absence of the instant application, there is no motivation to combine the references from these two technology areas.

Accordingly, the Applicants respectfully request that the obviousness rejection in view of Swager and Koma be withdrawn.

Claim 15 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Swager in view of Koma and U.S. Patent No. 4,109,241 (hereinafter 'Shanks'). Similar to Koma, Shanks also relates to liquid crystal display technologies. Shanks is relied upon for alleged teaching of a high-frequency electric field applied to the complex prior to applying the electric field. Shanks fails to cure the deficiencies of Swager and Koma as discussed above, even assuming that

Shanks is properly combinable. Therefore, Applicants respectfully request that the obviousness rejection of claim 15 be withdrawn.

An earnest endeavor has been made to place this application in condition for allowance. If the Examiner has any questions regarding this Response, Applicants respectfully request that the Examiner contact the undersigned.

Respectfully submitted,

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